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QUERY BY PROF. J. SCHEFFER.—“If of any curve we find the evolute, and of the latter the evolute, and so on ad infin., the ultimate evolute is a cycloid. How is this proved?”

ANSWER BY PROFESSOR KERSHNER.

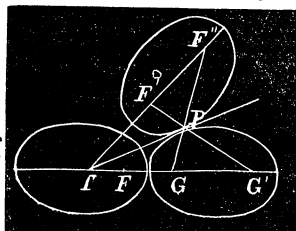
The evolute of a cycloid is an equal cycloid (Todhunter's Integral Calc. 5th ed., art. 114) composed of two equal parts which are not concurrent (Tod. Diff. Calc., art. 359), but which radiate in curvilinear rays, from each extremity of the original cycloid as two centers, forever, the maximum dist. of two succeeding extremities of the rays being  $2r$ .

NOTE BY PROF. SCHEFFER.—*Mr. Editor*: The proposition on page 71 Vol. IV, demonstrated by you, suggests the following:—

*Prop.*—The locus of the focus of an ellipse or hyperbola which rolls on an equal ellipse or hyperbola is a circle, supposing that at the beginning of the motion the vertices coincide.

If  $F, F', F'', G, G'$  represent the foci,  $PT$  a tangent,  $FPG'$  and  $F''PG$  are obviously straight lines and of constant length, viz., = major axis.

The locus, therefore, is a circle, the centre of which is the other focus and the radius of which is the major axis. The same reasoning applies to the hyperbola.



## PROBLEMS.

739. *By Geo. H. Harvill, Colfax, La.*—Required the average distance from the center of a circle to all points in the surface of a sector.

340. *By William Hoover, Wapakoneta, Ohio.*—Integrate  $\frac{dx}{\sin x + \cos x}$ .

141. *By William E. Heal, Marion, Ind.*—Show that “Every even number is the sum of two prime numbers, and every odd number is the sum of three prime numbers.” Barlow's Theory of Numbers, page 259.

342. *By Prof. Kershner.*—Prove Schlömilch's Theorem: If  $D_a, D_b, \dots$  are divisors of  $10^k + 1$ , so that  $N_a = \frac{10^k + 1}{D_a}$ ,  $N_b = \frac{10^k + 1}{D_b}$ ,  $N_n = \frac{10^k + 1}{D_n}$  the  $k$  digits or figures of the whole numbers  $D_a - 1, D_b - 1, D_n - 1$  are the  $k$  first figures of the circulator or period of  $\frac{1}{N_a}, \frac{1}{N_b}, \frac{1}{N_n}$ , respectively.